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EXAMINER

AMARI, ALESSANDRO V

ART UNIT PAPER NUMBER

2872

DATE MAILED: 08/07/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/820,710

Applicant(s)

KATO ET AL.

Examiner

Alessandro V. Amari

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 19 May 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-3, 5, 7-13, 37-46 and 56-59 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-3, 5, 7-13, 37-46 and 56-59 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 1, 3, 5, 7-9, 11, 13 and 54 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

In regard to claim 1, the recitation, "wherein said projection system is arranged to image, upon the image plane, only abaxial light from the object" is not adequately described in the specification. While the specification on page 40 makes reference to Figure 4 and shows that abaxial light from the first object 101, passing through a projection system and focusing an image on an image plane 102, there is no description of "**only** abaxial light" from the object being imaged onto the image plane. Examination of Figure 4 of the instant application, would lead one to surmise that not only abaxial light but also axial light would also be imaged onto the image plane. Therefore, this constitutes new matter. Claims 3, 5, 7-9, 11, 13 and 54 inherit the same issue due to their dependence on claim 1.

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

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4. Claims 1, 2, 3, 7-9, 10, 11, 13, 54, 56 and 57 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In regard to claims 1 and 10, the recitation of "a first imaging optical system, consisting of at least one first lens and at least one concave mirror" and "a second imaging optical system consisting of at least one second lens and at least one diffractive optical element" is ambiguous. This is because the transition phrase "consisting" is of the closed-type and thus the claim must be interpreted as having only the claimed components. However, the phrase "of at least one" implies that there could be more than one lens or diffractive optical element so that the number of optical elements being claimed is uncertain and indefinite. Claims 3, 5, 7-9, 11, 13, 54 and 57 inherit the same issue since they are dependent on claims 1 and 10.

In regard to claim 2, the recitation "the or lens, the or each mirror and the or each diffractive optical element" is ambiguous. The "or each" language makes it unclear whether all, some or none of the elements (lens, mirror, diffractive optical element) of the projection optical system have positive power. Claim 56 inherits the same issue since it is dependent on claim 2.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

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6. Claims 1-3, 5 and 13 are rejected under 35 U.S.C. 102(b) as being anticipated by Shafer et al U.S. Patent 5,999,310.

In regard to claim 1, Shafer et al discloses (see Figure 4) a projection optical system, comprising, a first imaging optical system (122) consisting of at least one lens (125) and said at least one concave mirror (124), for forming an intermediate image (126) of an object; a second imaging optical system (139), consisting of at least one second lens and at least one diffractive optical element as described in column 5, lines 65-67 and column 6, lines 48-54, for projecting the intermediate image onto an image plane (140); and a field optical system (127) disposed between said first and second imaging optical systems wherein said projection optical system is arranged to image, upon the image plane, only abaxial light from the object.

Regarding claim 2, Shafer et al. discloses (see Figure 4) a first imaging optical system (122) consisting of at least one lens (125) and said at least one concave mirror (124), for forming an intermediate image (126) of an object; a second imaging optical system (139), consisting of at least one second lens and at least one diffractive optical element as described in column 5, lines 65-67 and column 6, lines 48-54, for projecting the intermediate image onto an image plane (140); and a field optical system (127) disposed between said first and second imaging optical systems, the or each lens, the or each mirror and the or each diffractive optical element of said projection optical system all have positive power as shown in Figure 4 as is currently understood with the given claim language since Shafer et al includes elements with positive power.

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Regarding claim 3, Shafer et al. discloses that said at least one first lens, said at least one concave mirror, said at least one second lens and said at least one diffractive optical element have a positive power as shown in Figure 4.

Regarding claim 5, Shafer et al. discloses (see Figure 4) that said first and second imaging optical systems are disposed along a common straight optical axis as shown in Figure 4, and wherein abaxial light from the object as reflected and collected by said concave mirror passes through an outside portion of an effective diameter of said concave mirror as described in column 5, lines 58-61, toward the image plane side as shown in the lens group 122 in Figure 4.

Regarding claim 13, Shafer et al. further discloses (see Figure 4) a field stop (131) adjacent to an intermediate image to be formed by said first imaging optical system.

7. Claims 1-3, 10 and 13 are rejected under 35 U.S.C. 102(b) as being anticipated by Foo U.S. Patent 5,515,207.

In regard to claim 1, Foo discloses (see Figure 1) a projection optical system, comprising a first imaging optical system (20, 30), consisting of at least one first lens and said at least one concave mirror, for forming an intermediate image (70) of an object; a second imaging optical system (50), consisting of at least one second lens and said at least one diffractive optical element as described in column 2, lines 51-55, for projecting the intermediate image onto an image plane (15); and a field optical system (40) disposed between said first and second imaging optical systems, wherein said

projection optical system is arranged to image, upon the image plane, only abaxial light from the object.

Regarding claim 2, Foo discloses (see Figure 1) a projection optical system, comprising a first imaging optical system (20, 30), having at least one first lens and said at least one concave mirror, for forming an intermediate image (70) of an object; a second imaging optical system (50), having at least one second lens and said at least one diffractive optical element as described in column 2, lines 51-55, for projecting the intermediate image onto an image plane (15); and a field optical system (40) disposed between said first and second imaging optical systems, the or each lens, the or each mirror and the or each diffractive optical element of said projection optical system all have positive power as shown in Figure 4 as is currently understood with the given claim language since Shafer et al includes elements with positive power as shown in Figure 1.

Regarding claim 3, Foo discloses that said at least one first lens, said at least one concave mirror, said at least one second lens and said at least one diffractive optical element have positive refractive power as shown in Figure 1.

Regarding claim 10, Foo further discloses (see Figure 1) a projection optical system, comprising a first imaging optical system (20, 30), consisting of at least one first lens and said at least one concave mirror, for forming an intermediate image (70) of an object; a second imaging optical system (50), consisting of at least one second lens and said at least one diffractive optical element as described in column 2, lines 51-55, for projecting the intermediate image onto an image plane (15); and a field optical system

(40) disposed between said first and second imaging optical systems, a reflection surface (68) disposed adjacent an intermediate image formed by said first imaging optical system, and wherein abaxial light from the object as reflected and collected by said concave mirror is deflected by said reflection surface toward said second imaging optical system as shown in Figure 1.

Regarding claim 13, Foo further discloses a field stop adjacent to an intermediate image to be formed by said first imaging optical system as described in column 3, lines 40-53.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claim 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shafer et al. U.S. Patent 5,999,310 in view of Kuba U.S. Patent 5,623,365.

Regarding claim 11, Shafer et al discloses the invention as set forth above but does not teach wherein at least one of diffractive optical elements of said projection optical system satisfies a relation: $3 < MP/\lambda < 50$ where MP is a minimum pitch (micron) of the diffractive optical element, and λ is the exposure wavelength (micron).

Regarding claim 11, Kuba does teach use of diffractive optical elements which satisfy a relation $3 < MP/\lambda < 50$ where MP is a minimum pitch (micron) of the diffractive

optical element, and λ is the exposure wavelength (micron) as shown in Figures 8 and 11.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the diffractive optical element as taught by Kuba in the projection optical system of Shafer et al in order to correct chromatic aberrations.

10. Claims 54 and 56 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shafer et al U.S. Patent 5,999,310 in view of Stanton et al. U.S. Patent 5,631,721.

Regarding claim 54, Shafer teaches the projection optical system as described in claim 48 above and as described in column 3, lines 65-67, but does not teach a device manufacturing method, comprising the steps of, exposing a wafer to a device pattern and developing the exposed wafer.

Regarding claim 54, Stanton et al does teach a device manufacturing method, comprising the steps of, exposing a wafer to a device pattern and developing the exposed wafer as described in column 1, lines 15-19.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the projection optical system of Shafer et al in the method of Stanton et al. in order to increase semiconductor device manufacturing yields.

11. Claim 57 is rejected under 35 U.S.C. 103(a) as being unpatentable over Foo U.S. Patent 5,515,207 in view of Stanton et al U.S. Patent 5,631,721.

Regarding claim 57, Foo teaches the invention as set forth above but does not teach a device manufacturing method, comprising the steps of, exposing a wafer to a device pattern and developing the exposed wafer.

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Regarding claim 57, Stanton et al does teach a device manufacturing method, comprising the steps of, exposing a wafer to a device pattern and developing the exposed wafer as described in column 1, lines 15-19.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the projection optical system of Foo in the method of Stanton et al. in order to increase semiconductor device manufacturing yields.

Allowable Subject Matter

12. Claims 12, 37-46, 58 and 59 are allowed.

13. Claims 7-9 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

14. Claims 7 and 37 are allowable over the prior art for at least the reason that the prior art fails to teach or reasonably suggest, "a lens having a positive refractive power, a reflection mirror and said concave mirror, which are disposed in the order mentioned above, from the object side" as set forth in the claimed combination. Claims 8, 9 and 38-49, 59 are also allowable based upon their dependency on claims 7 and 37.

Claim 12 is allowable over the prior art for at least the reason that the prior art fails to teach or reasonably suggest "at least one of diffractive optical elements of said projection optical system satisfies a relation: $|L_d/L_{g2}| < 0.2$ where L_d is the distance between an aperture stop of said second imaging optical system and said diffractive optical element, and L_{g2} is the distance from an paraxial image plane position of an intermediate image formed by said first imaging optical system, corresponding to an

object point position of said second imaging optical system, to an re-imaging plane where the intermediate image is reimaged" as set forth in the claimed combination.

Claim 58 is also allowable based upon its dependency on claim 12.

The prior art of record, Shafer et al, Foo and Kuba teach a projection optical system with first imaging optical system with at least one lens, a concave mirror for imaging an intermediate image of an object and a second imaging optical system having at least one lens and an diffractive optical element for projecting the intermediate image onto an image plane and a field optical system disposed between said first and second imaging optical systems. Furthermore, the combination discloses that the first and second imaging optical systems are disposed along a common straight optical axis, and wherein abaxial light from the object as reflected and collected by said concave mirror is caused by said mirror to pass through an outside portion of an effective diameter of said concave mirror, toward the image plane side. However, the combination does not disclose that the first imaging optical system includes at least a lens having a positive refractive power, said reflection mirror and said concave mirror, which are disposed in the order mentioned above, from the object side. Neither does the combination teach that the diffractive optical elements in the system satisfy the aforementioned optical relationships and no motivation or teaching is present to modify this difference as derived.

Response to Arguments

15. Applicants arguments filed 19 May 2003 have been fully considered but they are not persuasive.

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The applicants argue that claim 1 as currently amended recites a first imaging optical system which consists of a first lens and a concave mirror only and a second imaging optical system which consists of a second lens and a diffractive optical element only. The prior art, Shafer et al describes first imaging system which includes a planar reflector as well as a meniscus lens and a concave spherical reflector and a second imaging optical system which has a refractive lens or a diffractive surface.

In response to this argument, the applicants should note that the Examiner has invoked a 112 2nd paragraph rejection on the claim language because the transition phrase "consisting" is of the closed-type and thus the claim must be interpreted as having only the claimed components but the phrase "of at least one" implies that there could be more than one lens or diffractive optical element so that the number of optical elements being claimed is uncertain and indefinite. Therefore, Shafer et al meets the currently recited limitations in so far as they are understood.

The applicants further argue that a further feature of claim 1 is that projection light is arranged to image, upon the image plane, only abaxial light from the object whereas Shafer discloses the use of axial light to form an image.

In response to the applicants argument, the applicants should note that the Examiner has invoked a 112 1st paragraph rejection on the claim language because the feature of only abaxial light from the object is not adequately described in the specification. Therefore, Shafer et al meets the currently recited limitations of "only abaxial light from the object" in so far as they are understood in light of the specification.

The applicants further argue that it is a feature of claim 2 that each mirror and diffractive optical element of the projection optical system has a positive power whereas Shafer et al fails to teach or suggest the use of only positive power lens, mirror and diffractive optical elements.

In response to this argument, the applicant should note that the Examiner has invoked a 112 2nd paragraph rejection on the claim language because the "or each" language makes it unclear whether all, some or none of the elements (lens, mirror, diffractive optical element) of the projection optical system have positive power. Therefore, Shafer et al meets the currently recited limitations in so far as they are understood.

The applicants further argue that claim 10 as currently amended recites a first imaging optical system which consists of a first lens and a concave mirror only and a second imaging optical system which consists of a second lens and a diffractive optical element only and a reflection surface adjacent the intermediate image which directs the light from the concave surface to the second imaging optical system. The prior art Shafer et al teaches additional elements as discussed above and fails to teach the feature of a reflection surface adjacent the intermediate image by which light from the concave surface is directed to the second imaging optical system.

In response to this argument, the Examiner would like to point out that there was no rejection cited in regard to claim 10 using the prior art, Shafer et al. Furthermore, the applicants should note that the Examiner has invoked a 112 2nd paragraph rejection on the claim language because the transition phrase "consisting" is of the closed-type and

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thus the claim must be interpreted as having only the claimed components but the phrase "of at least one" implies that there could be more than one lens or diffractive optical element so that the number of optical elements being claimed is uncertain and indefinite.

The applicants further argue that with respect to claims 1 and 10, the prior art, Foo does not teach the feature of a second imaging optical system consisting of at least one second lens and at least one diffractive optical element for projecting the intermediate image onto an image plane but instead teaches that the second imaging optical system which reimages the intermediate image 70 consists of mirrors 40 and lens 50. Further, Foo is devoid of any teaching or suggestion that the projection optical system is arranged to image, upon the image plane, only abaxial light from the object.

In response to this argument, Foo does teach that the system includes diffractive optical elements as described in column 2, lines 53-55 of Foo which clearly states: "The term "lens" as used herein is intended to include **diffraction-based** optical elements in addition to the widely-used refraction-based elements." (Emphasis Examiner's) As regards the applicants assertion that Foo does not teach or suggest abaxial light from the object the applicants should note that the arguments fail to comply with 37 CFR 1.111(b) because they amount to a general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the references. Furthermore, the applicants attention is directed to Figure 1 which clearly shows abaxial light from the object (see

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element 12 in Figure 1) which is collected and the concave mirror and is deflected by the reflection surface toward the second imaging optical system.

The applicants further argue that claim 2 recites that each lens, each mirror and each diffractive optical element all have a positive power but Foo does not teach or suggest any of these limitations.

In response to this argument, the applicants should note that the Examiner has invoked a 112 2nd paragraph rejection on the claim language because the “or each” language makes it unclear whether all, some or none of the elements (lens, mirror, diffractive optical element) of the projection optical system have positive power. Therefore, Foo meets the currently recited limitations in so far as they are understood.

Conclusion

16. Applicants amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

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the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alessandro V. Amari whose telephone number is (703) 306-0533. The examiner can normally be reached on Monday-Friday 8:00 AM to 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Drew Dunn can be reached on (703) 305-0024. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9318 for regular communications and (703) 872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

ava *ava*
July 31, 2003


MARK A. ROBINSON
PRIMARY EXAMINER